COMBATING INVASIVE PLANTS IN COMMUNITY FORESTS

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INVASIVE SPECIES

- "*With regard to a particular ecosystem, a non-native organism whose introduction causes, or is likely to cause economic or environmental harm or harm to human, animal or plant health*"
- Billions in damage and control cost in the United States annually (up to trillions worldwide).
- Worldwide impact is second only to human population growth as a cause of biodiversity loss (Pimentel, 2011)
- Most plant invaders were introduced in the US for food, fiber, and ornamental purposes.
- About 5,000 (out of about 25,000 exotic plants) exist in U.S. natural ecosystems compared to about 17,000 native species

INVASIVE SPECIES IN GA FORESTS

- **A field guide for the identification of invasive plants in southern forests** (General Tech. Report from USDA Forest Service)lists **56** nonnative species invading forests in 13 southern states

- Georgia Exotic Pest Plant Council (GA-EPPC) separates invasive plants in GA into four major categories.
  - **20** species are listed as **Category 1**
  - **"Exotic plant that is a <u>serious problem</u> in Georgia natural areas by <u>extensively invading</u> native plant communities and displacing native species"**

Category 1 Exotic Pests in Georgia Forests

	Scientific name	Common name	Habit	Origin
1	*Ailanthus altissima*	Tree-of-heaven	tree	Eastern China
2	*Albizia julibrissin*	Silktree, mimosa	tree	Asia
3	*Elaeagnus umbellata*	Autumn olive	shrub	Japan & China
4	*Hedera helix*	English ivy	vine	Europe
5	*Ligustrum sinense*	Chinese privet	shrub	East Asia
6	*Melia azedarach*	Chinaberry tree	tree	Asia
7	*Lonicera japonicum*	Japanese honeysuckle	vine	Japan
8	*Paulownia tomentosa*	Princesstree	tree	East Asia
9	*Pueraria montana*	Kudzu	vine	Japan & China
10	*Rosa multiflora*	Multiflora rose	shrub	Asia
11	*Triadica sebifera*	Chinese tallowtree	tree	China
12	*Wisteria sinensis*	Chinese wisteria	vine	Asia

Category 2 Pests in Georgia

- "Exotic plant that is a moderate problem in Georgia natural areas by invading native plant communities and displacing native species, but to a lesser degree than category 1"

	Scientific name	Common name	Habit	Origin
1	*Ardisia crenata*	Coral ardisia	shrub	Japan and India
2	*Cinnamomum camphora*	Camphortree	tree	Japan, China, Taiwan
3	*Elaeagnus pungens*	Thorny olive	shrub	Japan & China
4	*Ligustrum japonicum*	Japanese privet	shrub	East Asia
5	*Lonicera maackii*	Amur honeysuckle	shrub	Asia
6	*Nandina domestica*	Sacred bamboo	shrub	Eastern Asia & India
7	*Spiraea japonica*	Japanese spirea	shrub	Eastern Asia

WHY ARE THEY INVASIVE?

- Majority (though not all) invasive species are exotic.
- Exotic = escaping from their natural enemies (predators, herbivores, diseases).
- Aggressive invasives have some common traits:
  - Fast growth
  - Shade tolerance
  - Dense infestations
  - High seed densities often spread by animals
  - Sprouting from roots and underground shoots
  - Earlier leaf-out than native species

FEDERAL ACTION

- Legal patchwork – numerous federal laws deal with invasives (at least 19)
  - Georgia invasive species task force lists these along with summary of what each law covers https://www.gainvasives.org/regulations/
- Many laws yet invasives continue to spread, why?
- None of the laws is all encompassing, most are restricted to specific sectors, pathways, or species
- Maybe consolidation of legal authority and agency responsibility for invasives?

CONTROL & ERADICATION

- Many invasives have had decades to establish so fighting them will take decades and money!!
- Preventing introduction – by promoting and encouraging use of native species
- Making treatment and monitoring of invasives part of well designed management strategies for all forest programs
- Coordinated action between public and private stakeholders

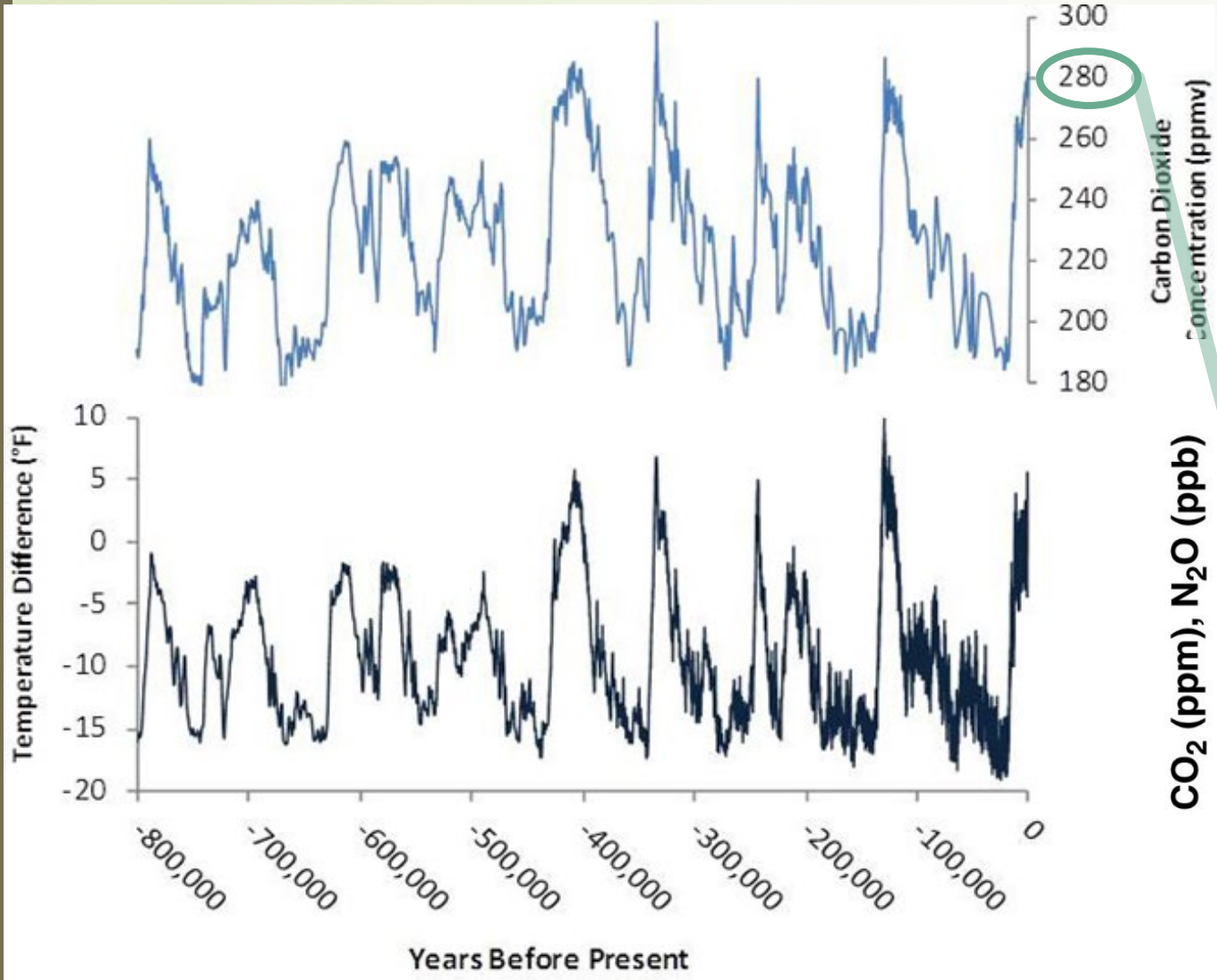
Treatment

- Often requires integration of multiple treatments for effective control, most commonly mechanical + chemical
  - Cutting alone often results in resprouts
  - Burning does not control roots and rhizomes
  - Mechanical root raking can intensify spread by chopping roots into resprouting segments
  - Overgrazing can increase spread through seed dispersal
  - Selective herbicides offer best option because they can kill roots

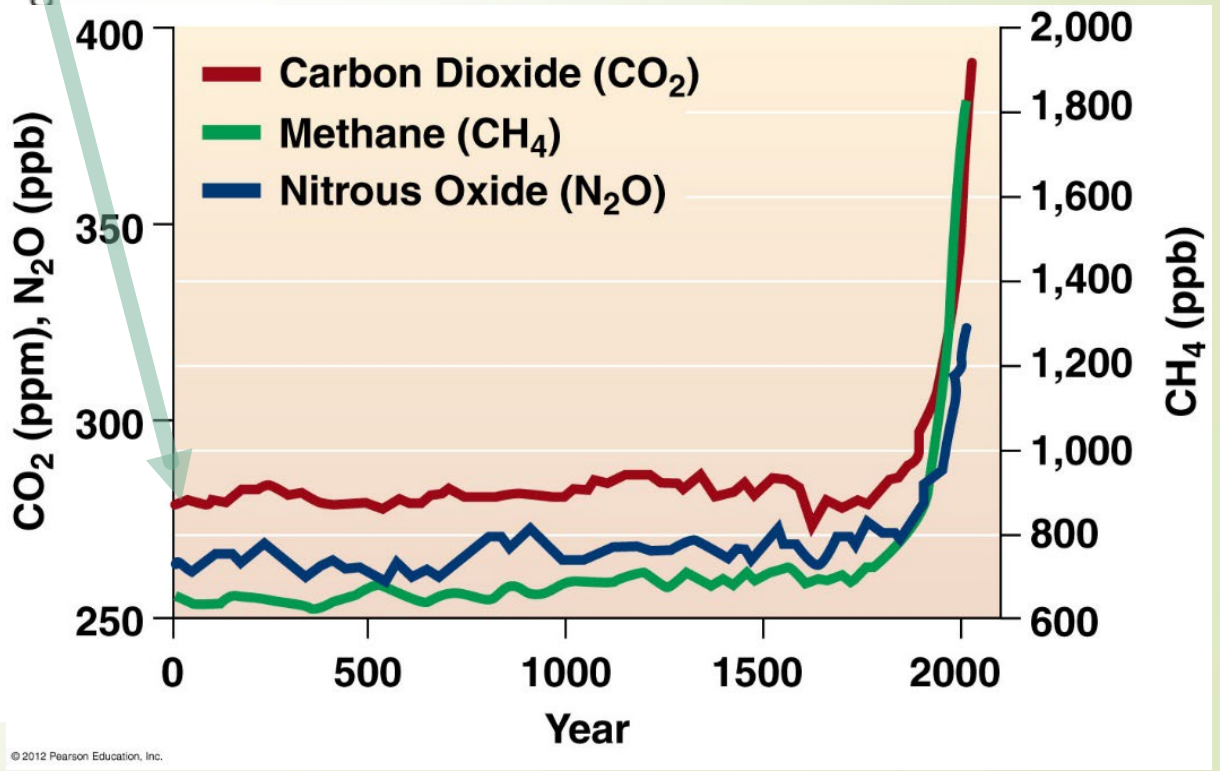
Web Resources for specifc treatment

- **A field guide for the identification of invasive plants in southern forests**. James H. Miller, Erwin B. Chambliss, Nancy J. Loewenstein (2010) USDA Forest Service, Southern Research Station. https://doi.org/10.2737/SRS-GTR-119
- Georgia Exotic Pest Plant Council https://www.gaeppc.org/
- **Invasive Plants of Georgia's Forests: Identification and Control** – Georgia Forestry Commission, University of Georgia, U.S. Forest Service https://gatrees.org/wp-content/uploads/2020/02/Invasive-Plants-of-Georgia-Forests.pdf
- Invasive Plants of the Eastern United States: Identification and Control www.invasive.org/eastern
- Southeast Exotic Pest Plant Council Invasive Plant Manual www.invasive.org/eastern/eppc/index.html
- Invasive plant atlas of the United States https://www.invasiveplantatlas.org/index.cfm

CONTRIBUTION TO CLIMATE CHANGE



http://www.nasa.gov/content/goddard/enormous-aquifer-discovered-under-greenland-ice-sheet/index.html



THE GLOBAL CARBON CYCLE

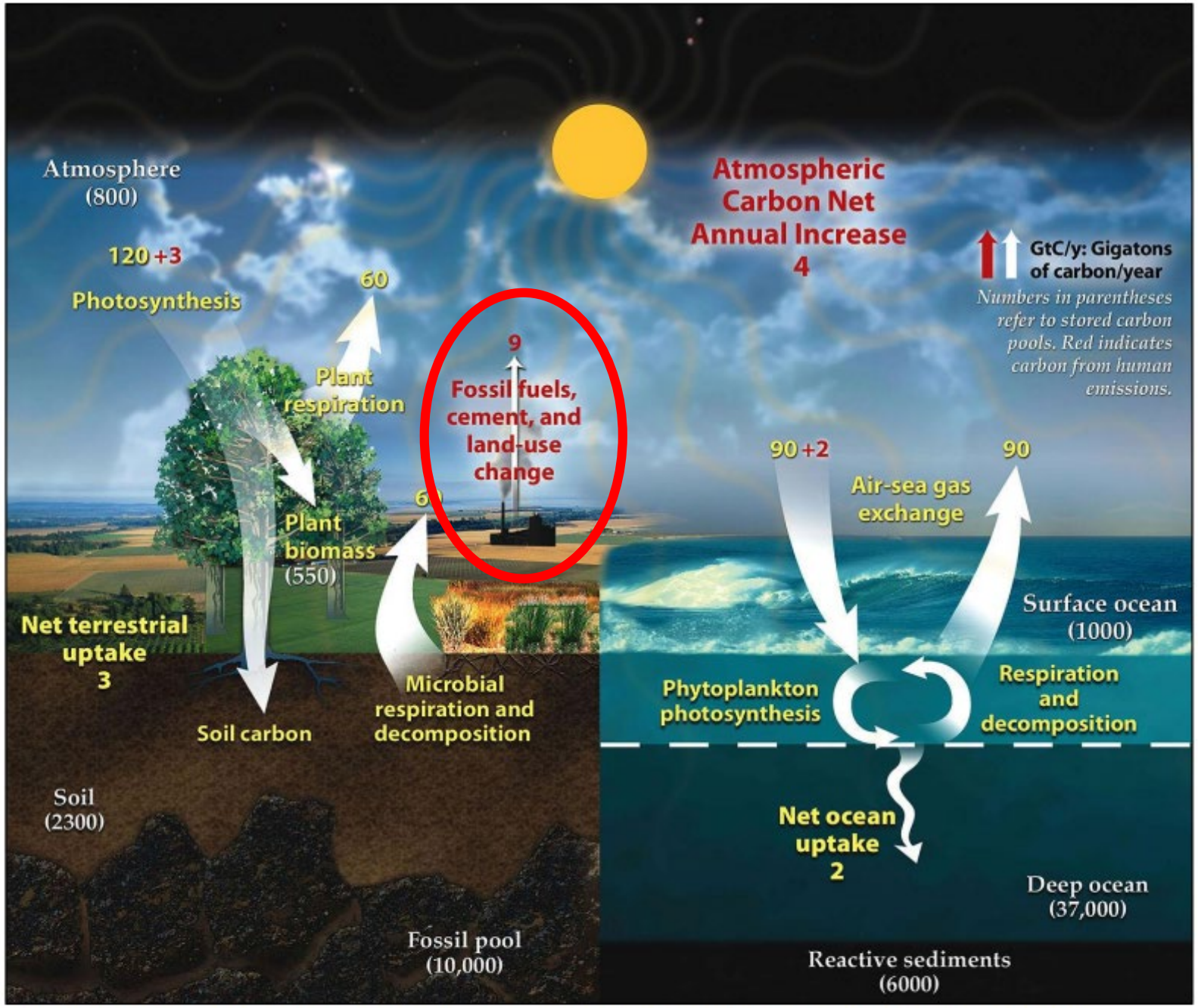


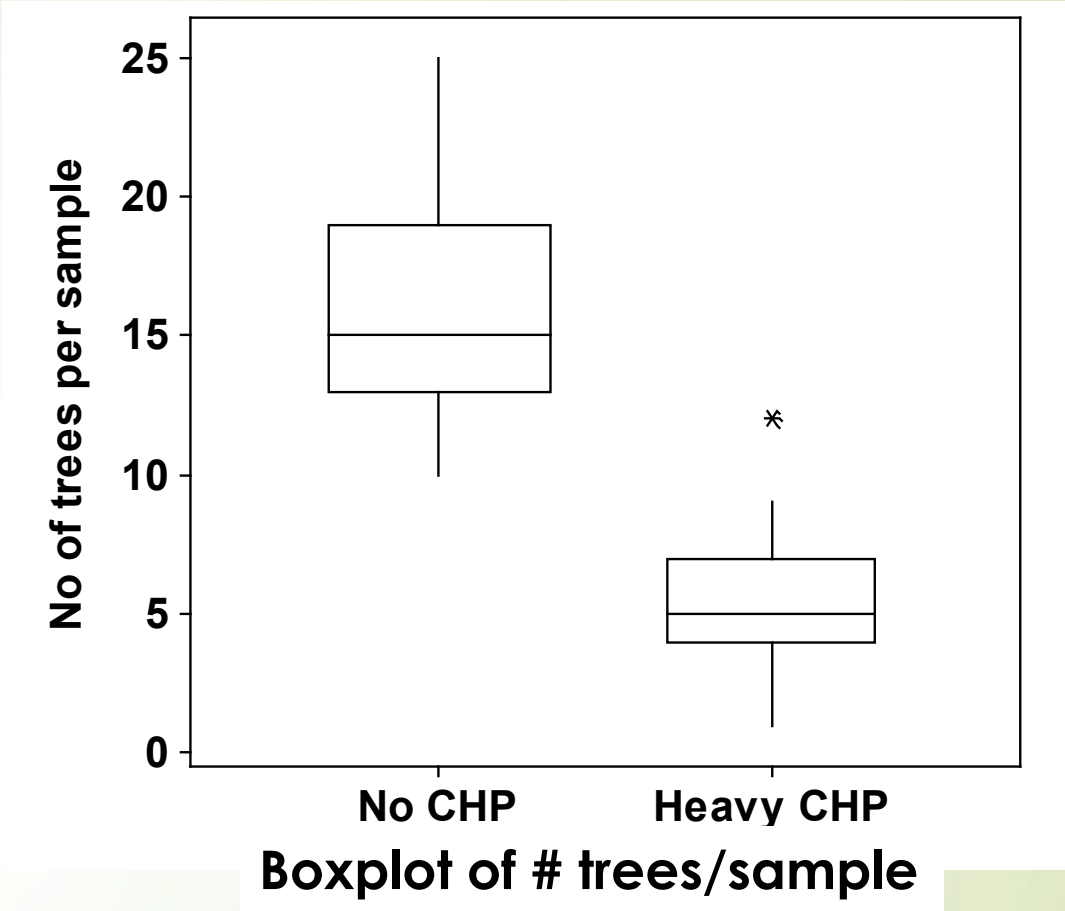
Figure 7.1: A simplified carbon cycle. Diagram adapted from U.S. DOE, Biological and Environmental Research Information System

Chinese privet (CHP) research

- ***Ligustrum sinense* Lour.** Native to SE Asia, introduced as an ornamental in 1852.

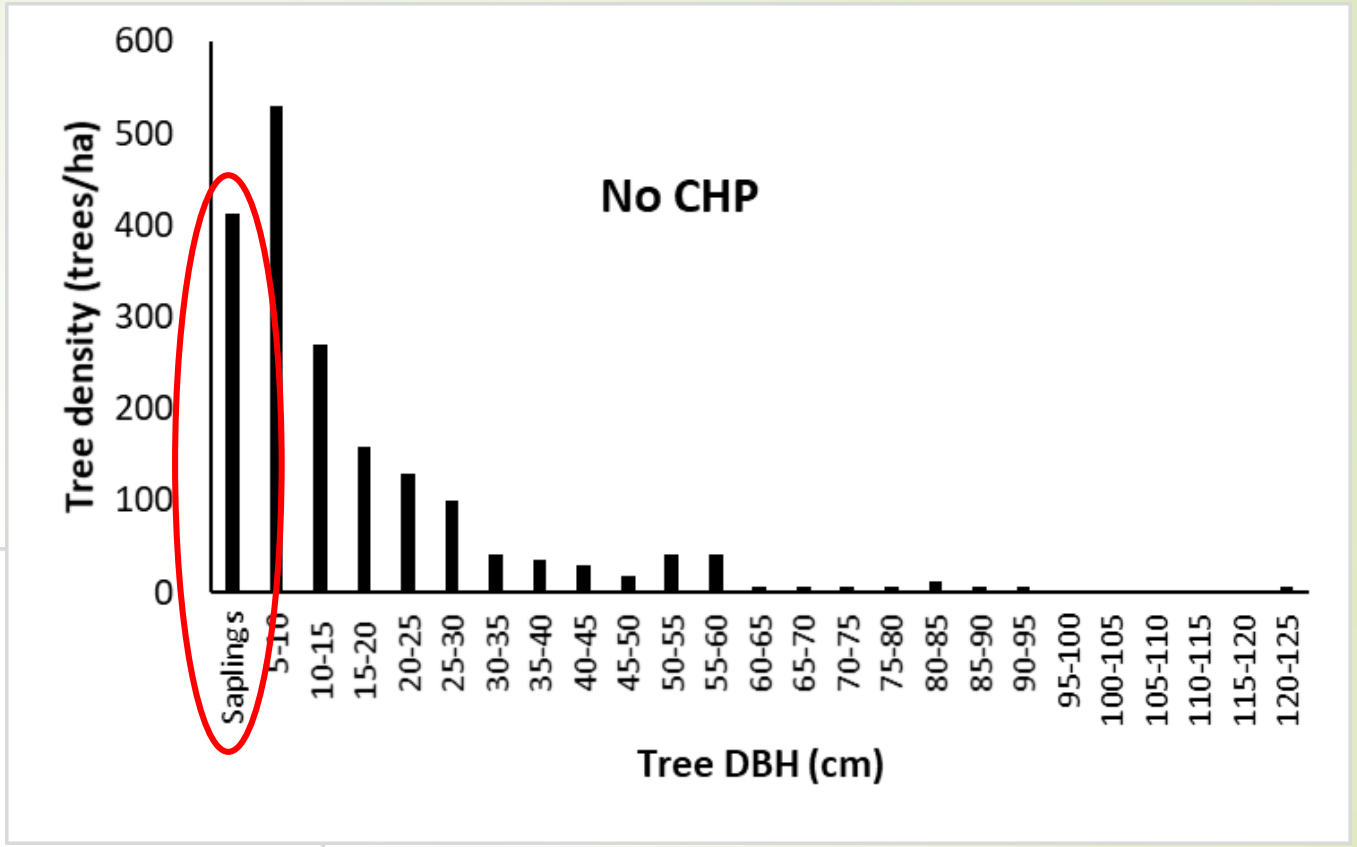
Species richness & tree density

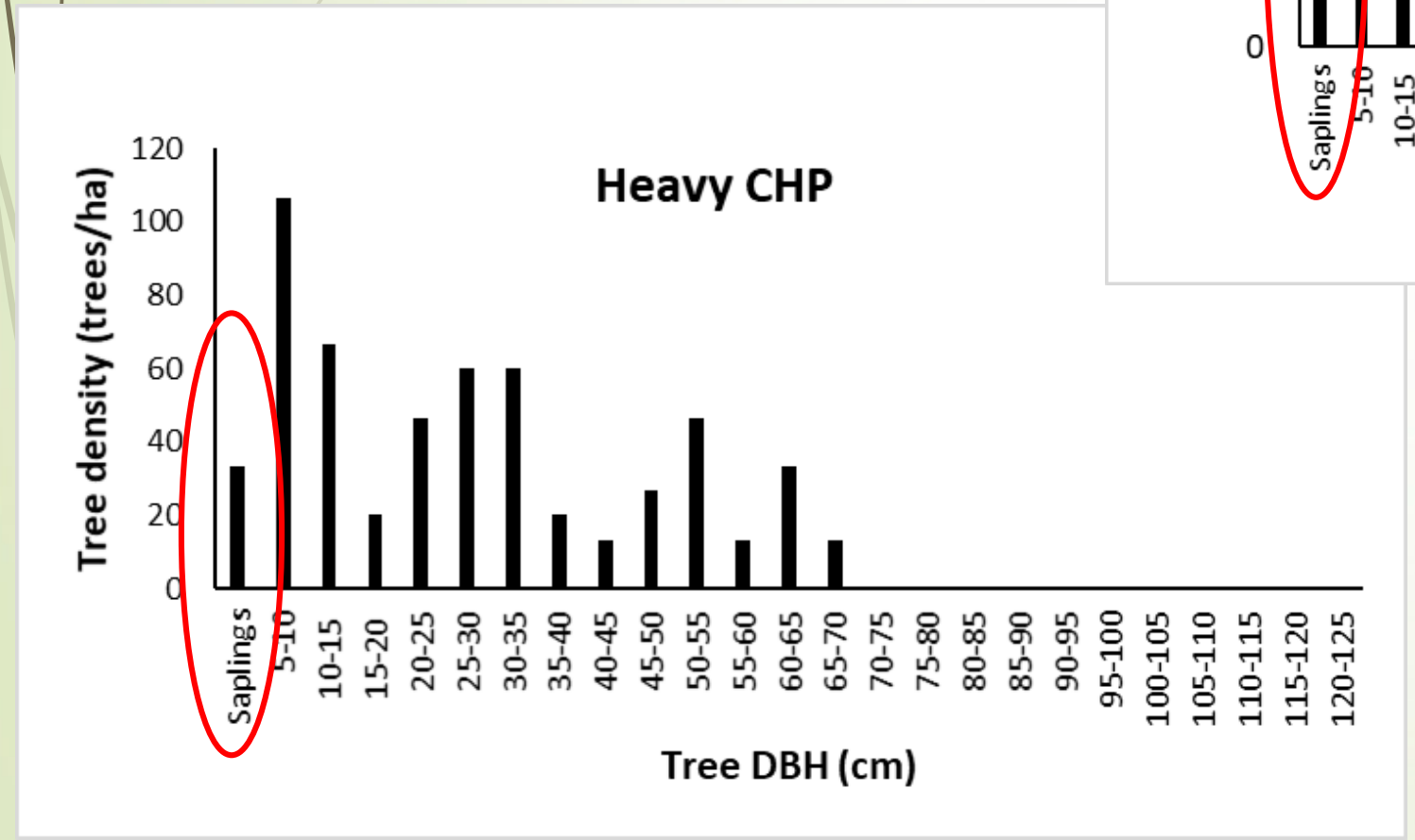
- Significantly lower species richness, tree density, and sapling density in heavy CHP samples than non-invaded samples (***P* < 0.01**).



	No CHP	Heavy CHP
Tree density (# trees/ha)	1594	533
Richness (# species/sample)	5	2.6
Sapling density (individuals/ha)	412	33

Tree distribution by DBH size

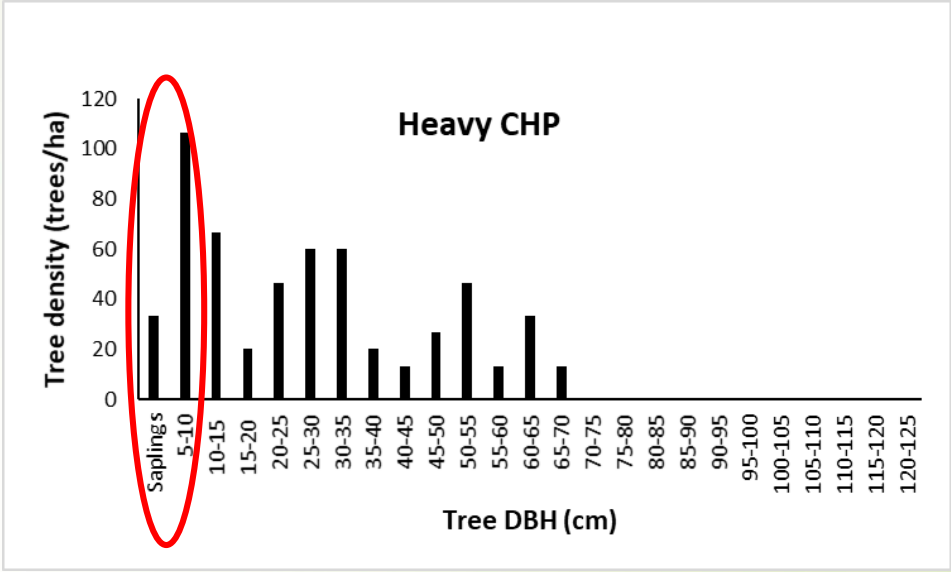




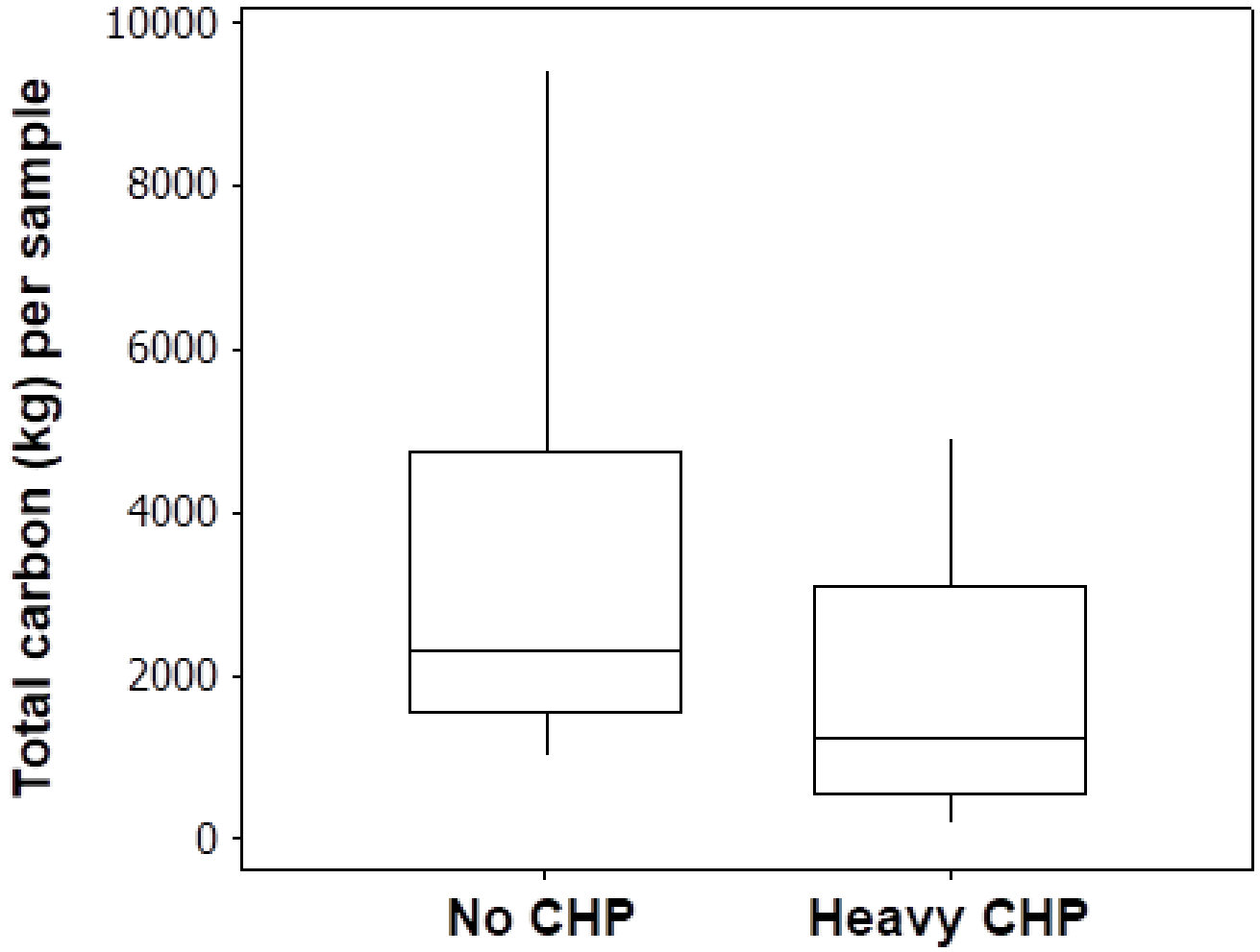
Future of wooded natural areas

- Without enough juvenile native trees to replace old or fallen canopy trees, wooded natural areas will degenerate into areas dominated by invasive shrubs like privet and honeysuckle

  In the absence of serious intervention, such an outcome seems inevitable.



Amount of Carbon in forest biomass



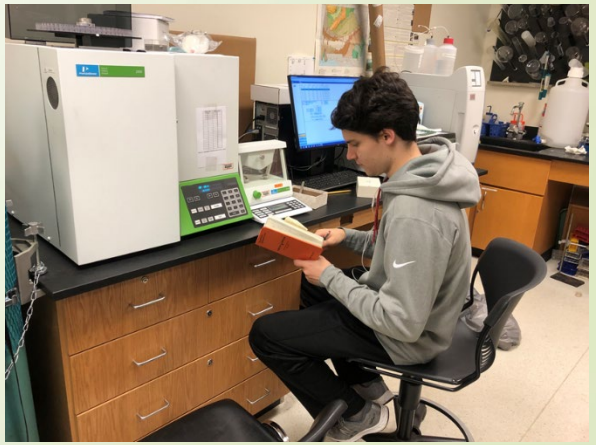
Boxplot of C (kg/sample)

- Significantly less C in heavy CHP samples than non-invaded samples (***P* < 0.01**).

Sample	Mean C (kg/ha)	Average deficit	Percent deficit
No CHP	334,358		
CHP (W/O CHP-C)	108,386	(225,972)	**67.58**
CHP (CHP-C added)	118,971	(215,386)	**64.42**

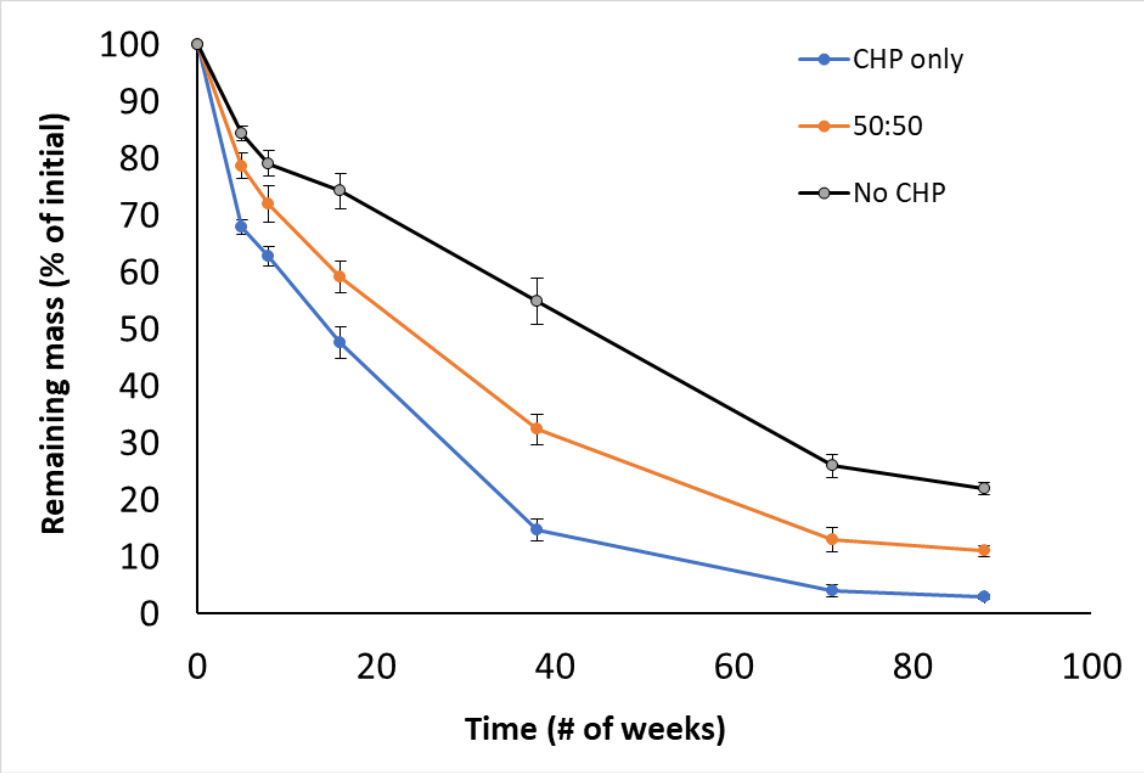
Decomposition

- Nov 2017 – Aug 2019 – used the litterbag (20 cm x 20 cm) method to compare decomposition rates of different litter combinations



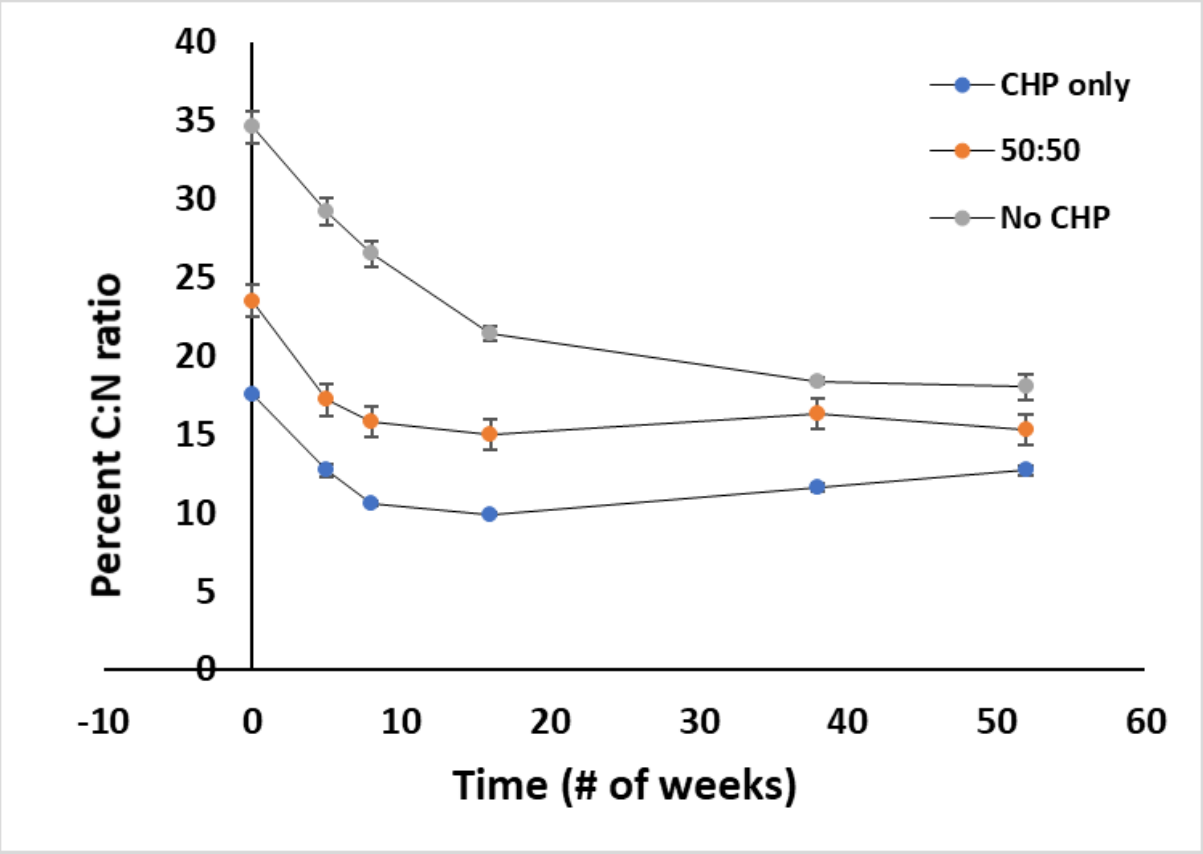
Decomposition rates

- CHP litter decomposed significantly faster than the other treatments (***P* <0.001**)



Average remaining mass as a percent of initial mass (g)(mean ± 1SE)

- CHP litter starting with significantly higher N content than non-CHP (***P* <0.001**)



Average percent C:N ratio with time (mean ± 1SE)

Privet & Climate change

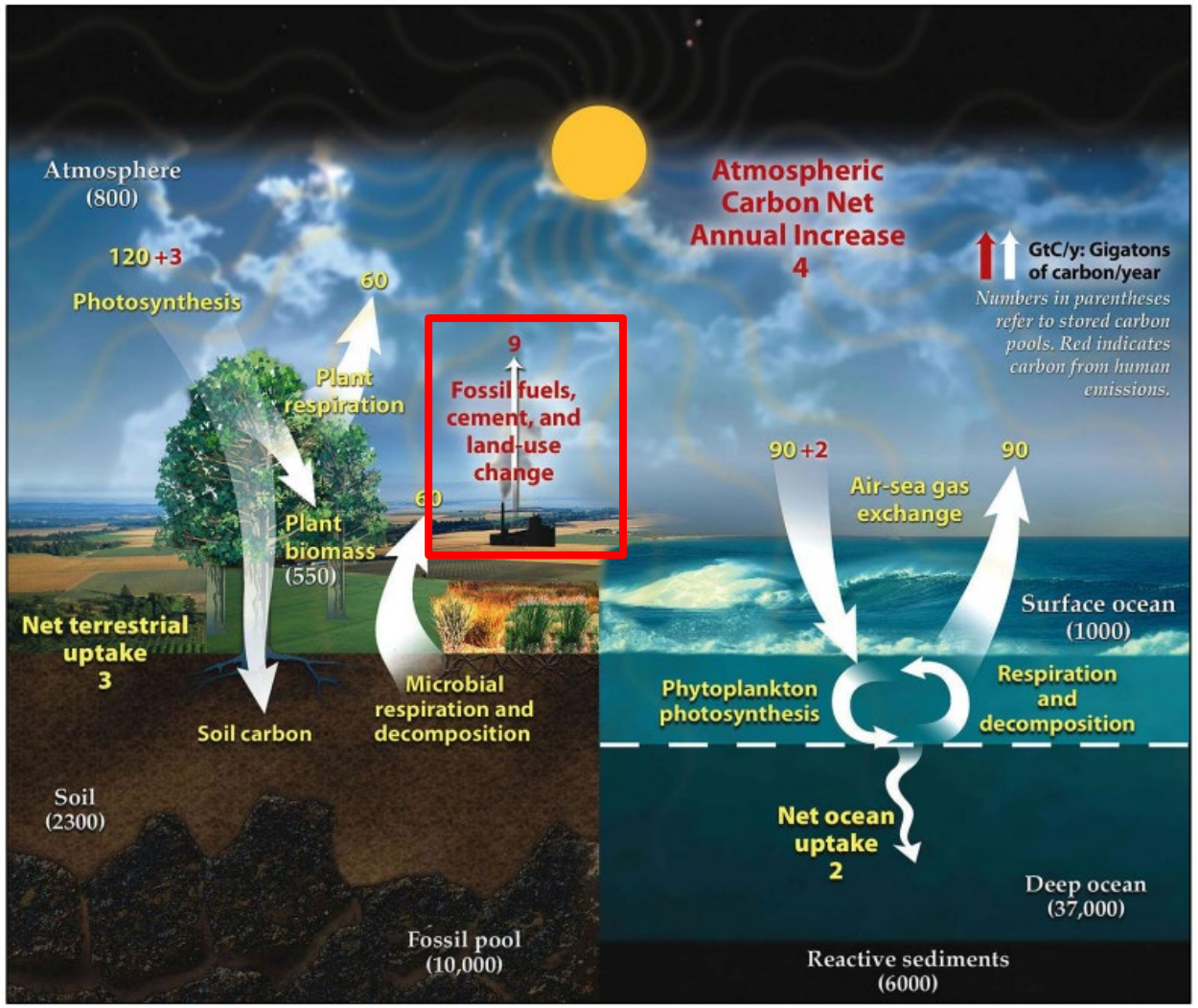


Figure 7.1: A simplified carbon cycle. Diagram adapted from U.S. DOE, Biological and Environmental Research Information System.

- Heavy presence of Chinese privet results in loss in C sequestration capacity of native forests.
- This potentially adds to the "**land use change**" flux of the C-cycle thus contributing to increase in atmospheric C.

Further Research

- **Current on-going work is assessing amount of soil organic C under heavy privet vs no privet**
  - Every ha forest with heavy CHP presence stores less C in live biomass.
  - Less live biomass means less litter to the forest floor, which is an important source of soil C
  - Long term consequence might be significant decrease in soil C due to loss in litter supply.

Some references

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